



Q-prove: Fighting wooden breast without compromising performance

Thanks to a strong consumer demand, poultry meat production has increased substantially (Figure 1). This growth is related to the perceived healthy and nutritional content, the suitability for further processing and the cheaper price compared to red meats. To fulfil the increase in demand there was a selection for higher growth-rate and breast-yield chicken hybrids. However, improved live performances have been accompanied by an increased incidence of muscle abnormalities. Among those is the occurrence of wooden breast:

visually hard, out-bulging and pale areas on the ventral surface of the Pectoralis major muscle.

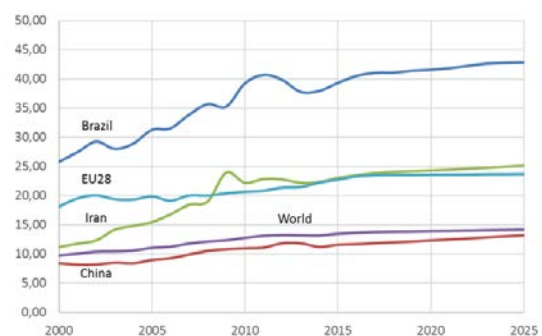


Figure 1: Poultry meat consumption per capita (source: OECD)

What is wooden breast?

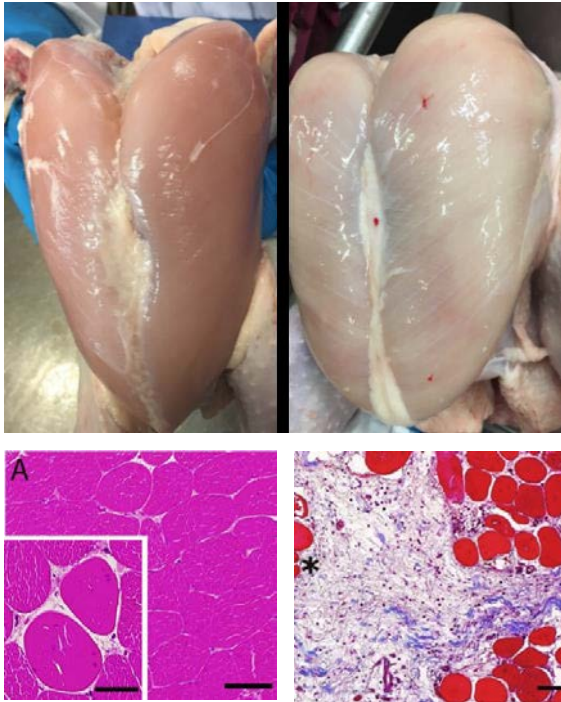


Figure 2: Wooden breast myopathy at slaughterhouse (above) and microscopic sample (below)

left: Unaffected muscle with normal color and consistency,

right: Wooden breast myodegeneration, hardened and pale muscle

Wooden breast can be observed in all breeds and strains of chickens as early as 2 weeks of age with varying prevalence and with a wide range of slaughter weights, management, feeding and rearing systems.

The cause of wooden breast

The exact cause of wooden breast is yet to be identified. There is evidence that wooden breast is caused by expansion of the muscle cells. In that case, there are limitations of blood supply (oxygen and nutrients) to and metabolic waste-product removal (carbon dioxide and lactic acid) from the muscle cells. Breast muscle cells of broiler chickens are made of predominantly anaerobic muscle fibers that are extremely susceptible to stress. The presence of oxidative stress in affected muscle cells is well supported by research. Due to the stress, there is a loss of cellular homeostasis and a breakdown of the muscle fiber membrane. This will trigger an inflammatory and regenerative response in the muscle. When the extent of muscle damage exceeds the capacity of the repair system, the intracellular free oxygen radical concentration increases, resulting in cell death and inflammation. The damaged muscle tissue is then replaced with collagen.

The fast muscle growth is characterized by increased muscle cell sizes (hypertrophy) and not by increased cell numbers (hyperplasia). Nowadays, the growth is so fast, that the efficiency and growth rate can overwhelm the regulatory and homeostatic mechanisms. This can result in cellular dysfunctioning and can lead to breast muscle abnormalities. Breast fillets affected by the myopathy are hardened or show hardened ridges. Affected fillets can also exhibit white striping. Breast fillets affected by wooden breast and white striping exhibit a poorer nutritional value, a harder texture and an impaired water holding capacity as compared to normal fillets.

Breast myopathies are usually noticed after slaughtering and carcass-portioning of the birds, as no growth problems and/or health issues are detected during the lifetime. Pale and hard areas in the breast meat fillet are found post-mortem. Affected breast muscles show strong changes in color, texture and composition. In Figure 2, normal and severe wooden breast fillets are compared: in case of severe wooden breast, the muscle cells are replaced with collagen.

Genes involved

Recently, much attention has been paid to the identification of the genetic factors involved in the development of wooden breast syndrome, with some success. Recent gene expression analysis showed that local hypoxia and oxidative stress are the significant factors in the pathogenesis of these myopathies. Important biomarkers that can help the industry to assess the severity of wooden breast and also its subclinical cases have been found already. However, as it is widely believed that the syndrome is a consequence of the high weights and quick growth of modern birds, this suggests the unavoidable tradeoff, wherein lower rates of wooden breast are achieved at the cost of feed efficiency and growth rates. In other words, suboptimal production with lower benefits. Therefore, the industry is interested in nutritional solutions that will avoid the need for changes in genetics.

Detection and grading of wooden breast quality

It is impossible to do the detection and the grading in the slaughterhouse manually. That is why new methods for rapid and non-destructive detection and grading of wooden breast syndrome in chicken breast fillets are developed. Near-infrared (NIR) spectroscopy is often chosen as detection method for large scale on-line detection of the syndrome. There are two approaches possible: Linear discriminant analysis based on NIR spectra and a regression model for protein based on the estimated concentrations of protein. Some tests already showed a 99.5-100 % correct classification of the breast fillets. Such methods enable automatic quality sorting of chicken fillets to different product categories. In that way, manual laborious grading can be avoided. Every farm and flock can be monitored and this information can be used to understand the main causes of wooden breast in the chicken production.

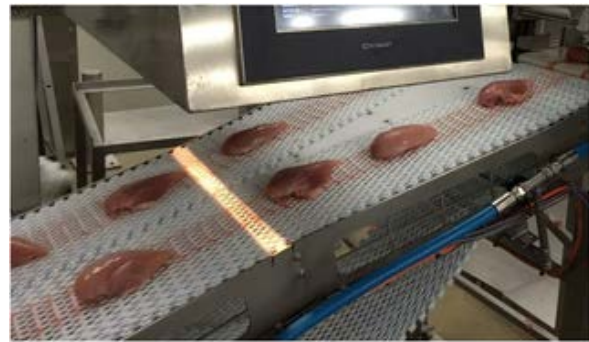


Figure 3: Detection and grading of breast fillets

Impact

Due to the changes in composition and the pale, hard areas, there is a change in the appearance of the fillet. This causes a consumer perception of a fatty and less healthy breast fillet. Therefore wooden breast fillets won't end up in retail. Batches with severe wooden breast will be integrated in processed meat products and pet food and equals lower profit. However due to the different chemical composition, characterized by high fat and collagen, and low protein contents, the processing attributes change.

The wooden breast condition occurs most frequently in fast growing, high breast yielding broilers. The incidence also seems to be higher in broilers that are male, on nutrient dense diets, slaughtered at older ages or heavier weights. Although industry-wide incidence numbers are difficult to assess, available data suggest that 5-10% of commercially produced breast fillets exhibit wooden breast. Nuscience trials showed that for birds at a higher age (around 42 days), the incidence of severe wooden breast can go up to 20% at some farms.

Solutions

Different approaches have been put forward to decrease the incidence of wooden breast. Through genetics, it's clear that lower breast meat yielding chickens will show lower incidence of wooden breast. Through management, farms can reduce growth rate between 13 – 21 days and try to avoid factors inducing (oxidative) stress such as heat, diseases/inflammation, overcrowding and activity. However, it is important not to sacrifice performance and profit whilst tackling wooden breast. Nutritional solutions consist of a good growth at start, achieved with extra protein in the (pre)starter, resulting in a higher number of muscle cells (hyperplasia) and improving oxygen transport or preventing muscle cell damage with special feed-additives.

Nuscience developed and validated Q-prove®, a product to combat wooden breast without changing the diet and without losing performance. The Nuscience approach consists out of 3 modes of action: Increasing anti-oxidant activity, stimulation of the blood circulation and reducing inflammation and temperature rise in the breast muscle cells. Wooden breast cannot be cured and therefore has to be prevented. That is why Q-prove® should be dosed from the beginning until the end.

Q-prove field trial

A field trial was carried out on a commercial farm in The Netherlands (2017). The farm was suffering from high incidences of wooden breast. Nuscience tested in detail 300 carcasses from the control and 150 carcasses from the Q-prove® fed group in the slaughterhouse. The scoring (score 0 = no wooden breast, score 1 = moderate wooden breast but no financial consequence, score 2 = severe wooden breast with financial consequence) was performed by a Doctor of Veterinary Medicine with more than 35 years of experience in poultry carcass quality

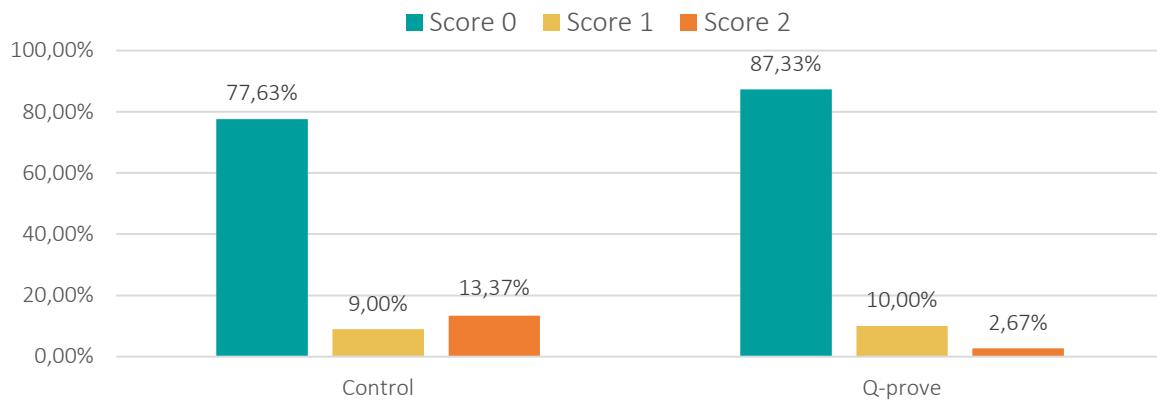


Figure 2: Wooden breast scoring of broiler carcasses, Control versus Q-prove®

Conclusion

The results show a clear effect of Q-prove® on the occurrence of severe wooden breast. In the trial the amount of severe wooden breast fillets decreased with 10.7% (Figure 2). Q-prove® is an additive that decreases the incidence of wooden breast without the need to adjust the composition of the diet. For this reason, with Q prove® it is possible to make full use of the genetic potential.

Claims associated with products may be different based on government requirements. Certain statements may also not be applicable in all regions.

More information

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